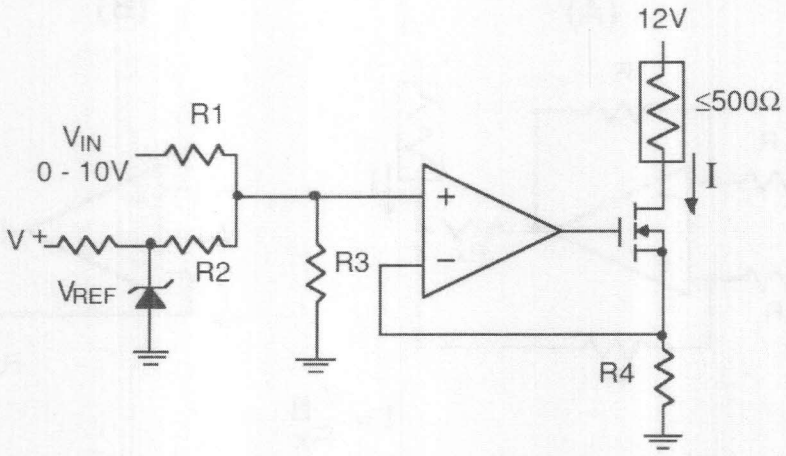
Current Sink with Scaling and Offset



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An additional reason for using the buffered current sink of circuit B is that it offers a greater compliance range. When V_{IN} is at its maximum level the 500Ω load is conducting 20 mA; on a 12V supply, this leaves only 2V for the current sink driver.

Since the circuit's input voltage is 0 to 10V, and the maximum voltage allowed across the current sense resistor is 2V, the input voltage must be prescaled before being applied to the op amp input. In addition, the minimum load current is to be 4 mA when V_{IN} = 0V; this requires that an offset be added to the input voltage.

The circuit shown above uses R4 as the current sense resistor. The prescaling with offset is done with R1, R2, and R3:

$$I = \frac{V_{IN} \times X + V_{REF} \times Y}{R4}$$

where

$$X = \frac{1/R1}{1/R1 + 1/R2 + 1/R3}$$

and

$$Y = \frac{1/R2}{1/R1 + 1/R2 + 1/R3}$$